

CLAIMS:

WE CLAIM

1. A method of making a single crystal casting, comprising
providing a nickel base superalloy that includes Cr, Co, Mo, W, Ta, and Al as alloying elements and that exhibits as-cast metallic surface scale when the superalloy is cast as a single crystal casting with a C concentration effective to substantially reduce formation of said as-cast metallic surface scale, and
solidifying the superalloy in a mold to form a single crystal casting.
2. The method of claim 1 wherein said nickel base superalloy includes at least one of Ti, Re, Hf, Y, a rare earth element, Mg, and B.
3. The method of claim 1 wherein the superalloy as-cast is free of said scale.
4. The method of claim 1 including solution heat treating the casting wherein recrystallized grains are reduced after heat treatment.

5. A method of making a single crystal casting, comprising

providing a nickel base superalloy consisting essentially of, in weight %, about 6% to 6.8% Cr, about 8% to 10% Co, about 0.5% to 0.7% Mo, about 5.0% to 6.6% W, about 6.3% to 7% Ta, about 5.4% to 5.8% Al, about 0.6% to 1.2% Ti, about 0.05% to 0.3% Hf, up to about 100 ppm by weight B, up to 50 ppm by weight Mg, and balance essentially Ni that exhibits as-cast metallic surface scale when the superalloy is cast as a single crystal casting, including providing said superalloy with a C concentration greater than 0.04 weight % effective to substantially reduce formation of an as-cast metallic scale when the superalloy is cast as a single crystal and solidifying the superalloy in a mold to form a single crystal casting.

6. The method of claim 5 wherein the superalloy as-cast is free of said scale.

7. The method of claim 5 including solution heat treating the casting wherein recrystallized grains are reduced after heat treatment.

8. The method of claim 5 wherein C is included in an amount of greater than 0.04% to about 0.1% by weight.

9. A method of making a single crystal casting, comprising providing a nickel base superalloy including Cr, Co, Mo, W, Ta, and Al as alloying elements that exhibits as-cast metallic surface scale when the superalloy is cast as a single crystal casting, including providing said superalloy with a C concentration controlled in accordance with the equation,

$$\% \text{ area fraction scale} = -0.193 \times \text{carbon content in ppm} + 86$$
effective to substantially reduce formation of an as-cast metallic scale when the superalloy is cast as a single crystal and solidifying the superalloy in a mold to form a single crystal casting.

10. The method of claim 9 including heat treating the casting wherein recrystallized grains are reduced after heat treatment.

11. The method of claim 9 wherein said superalloy includes at least one of Ti, Re, Hf, Y, a rare earth element, B, Mg, and B.

12. As cast, metallic scale-free single crystal nickel base alloy casting consisting essentially of, in weight %, of about 6% to 6.8% Cr, about 8% to 10% Co, about 0.5% to 0.7% Mo, about 5.0% to 6.6% W, about 6.3% to 7% Ta, about 5.4% to 5.8% Al, about 0.6% to 1.2% Ti, about 0.05% to 0.3% Hf, up to about 100 ppm by weight B, up to 50 ppm by weight Mg, up to 100 ppm Y and balance essentially Ni and a C concentration greater than 0.04 weight %, said casting being substantially free of as-cast metallic scale.

13. The casting of claim 12 wherein the Hf content is from about 0.15 to about 0.30 weight %.

14. The casting of claim 12 including Re.

15. Single crystal nickel base alloy consisting essentially of, in weight %, of about 6% to 6.8% Cr, about 8% to 10% Co, about 0.5% to 0.7% Mo, about 5.0% to 6.6% W, about 6.3% to 7% Ta, about 5.4% to 5.8% Al, about 0.6% to 1.2% Ti, about 0.15% to 0.3% Hf, up to about 100 ppm by weight B, up to 50 ppm by weight Mg, up to 100 ppm Y and balance essentially Ni and a C concentration greater than 0.04 weight % to produce a single crystal casting substantially free of as-cast metallic scale when the alloy is cast as a single crystal.

16. The casting of claim 15 including Re.

17. A method of making a single crystal casting, comprising

providing a nickel base superalloy that includes Cr, Co, Mo, W, Ta, and Al as alloying elements and that exhibits grain recrystallization when the superalloy is solution heat treated, including providing said superalloy with a C concentration effective to substantially reduce grain recrystallization during heat treating, and

solution heat treating the superalloy.

18. The method of claim 17 wherein said nickel base superalloy includes at least one of Ti, Re, Hf, Y, a rare earth element, Mg, and B.

19. The method of claim 17 wherein said nickel base superalloy consisting essentially of, in weight %, about 6% to 6.8% Cr, about 8% to 10% Co, about 0.5% to 0.7% Mo, about 5.0% to 6.6% W, about 6.3% to 7% Ta, about 5.4% to 5.8% Al, about 0.6% to 1.2% Ti, about 0.05% to 0.3% Hf, up to about 100 ppm by weight B, up to 50 ppm by weight Mg, greater than 0.4% C, and balance essentially Ni.

20. The method of claim 17 wherein the Hf content is from about 0.15 to about 0.30 weight %.